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Dear Mrs. Rowe: March 27, 2018

You have asked me to summarize my presentation to the staff of the Childrens' Hospital of Los Angeles regarding the recent leukemia experience in those regions of Los Angeles County adjacent to Ventura County and less than 5-6 miles from the Santa Susana Field Laboratory (SSFL).

As you know, SSFL has been in operation since 1948 and covered an area of nearly 3000 acres. During the 70's and 80's it was extensively used for the testing of rocket engines and rocket fuel by North American Aviation, Rocketdyne, NASA, DOE, and Boeing. The activities were not fully disclosed to the public, and many have presumed, with some reason that the materials used were probably not meticulously cleaned up, and the companies have not been especially forthcoming in the past. These materials included solvents, such as TCE, Hydrazine fuel, heavy metals, perchlorate, PCB's, PAH's, Dioxins, Furans, and nuclear research produced radionuclides such as Cesium 137 and Strontium 90. Many of these compounds are possible or probable carcinogens, and a study of Rocketdyne conducted by investigators from UCLA concluded that some lung cancers among the workers were probably due to radiation exposure on the job.

For these legitimate reasons, there have been concerns among the residents of nearby areas since at least the 1970's that they and their children have been endangered by proximity to the SSFL location. However, attempts by the California Toxics agency and the EPA to identify dangerous levels of carcinogens and ionizing radiation in areas near to the site have not documented dangerous levels in any recent surveys. According to the EPA after their radiological survey results, they stated in their May 2012 newsletter: "Site access is restricted and therefore, the public is not exposed to this contamination." However, most would agree that in this case the empirical evidence of cancer incidence among nearby residents would be a better guide to the magnitude of the problem. Unfortunately, there is no way to measure levels of cumulative exposure to carcinogens on a personal basis. People move in and move out, unaffected families cannot always be expected to be as cooperative as affected families, and the levels of education and income among nearby residents are quite different from those of all residents of the two Counties. Studies of individuals are quite expensive and require extended periods to complete.

For these reasons, the studies that have been done are not of individuals, but of populations, and have been of the "quick and dirty" kind, in which the cases occurring among blocks of nearby residents have been compared to overall county rates. Such studies have their own problems. In addition to the above, counts of residents needed to estimate rates of incidence are only made every decade, and with particular reference to children, the inter-census extrapolations cannot be assumed to be accurate.

None of the four studies conducted in the past were able to find evidence of a link between SSFL and "offsite" cancer occurrence, but these studies tended to make arbitrary assumptions about the uniformity of exposure to large groups, and paid insufficient attention to the differences between local residents and the population at

large. For these reasons I was requested by the State agencies to analyze the adult cancer occurrence by neighborhood (census tract), calendar period, gender and anatomic site. I examined 13 kinds of cancer in each gender in 130 different census tract-periods from 1988 to 2009 and found no evidence of a relationship between "offsite" residence and cancer incidence.

None of these studies considered childhood cases. I was recently asked by the State, by CHLA, and by some groups of local residents (understandably, residents are not in perfect agreement about the best course of action) to re-examine offsite risk, this time with attention to childhood (0-14) cancer and leukemia in particular. My colleagues and I have done so, again looking at each census tract within an area slightly greater than 5 miles from SSFL. At that farthest distance, carcinogens from on site would be unlikely to be present in doses that could produce extra cases, much less clustered cases. We looked at four periods, including the more recent one of 2010-2015.

You have asked that I describe our findings with respect to that period and in particular to the "offsite" census tracts in Los Angeles County, including West Hills. Overall we found no trend over time in the frequency of childhood cancer or of leukemia (ALL and AML), no consistent excess by census tract. Those census tracts within 3 or 5 miles of the site in either County saw no more cases than those more distant. No more than two cases of leukemia occurred in any one census tract, and even that number occurred only twice among the 60 tracts with such cases. As indicated above, calculation of local incidence is not feasible on account of the unreliability of the population counts, so we looked at the percent of all cancers diagnosed represented by childhood cancer (since the large number of adult cancer types has ensured that the total number closely reflects the population in California), and in each period these were consistent with the overall percentage.

With respect to leukemia occurring in areas of Los Angeles County adjacent to the Ventura County border and therefore relatively near SSFL, we counted cases in 15 census tracts and found 5 cases of acute leukemia. Based on an estimate of the combined population of those tracts, and the five years at risk, one should have expected two cases, so there were more observed than expected. However, before we conclude that the 3 unexpected cases were a result of exposure to the relatively distant (in dosage terms) SSFL site, we must calculate the probability that such an outcome would result by chance. That takes the form of estimating how many of the many groups of 15 tract combinations in either County would be likely to see this many or more cases of childhood cancer by chance. There are roughly 3000 census tracts in the two Counties, and even if they were divided such than no census tract was in more than one 15-tract set, there would be 200 sets. Using the Poisson statistical method of estimation, we calculated that 5.2% of all the units under surveillance would see 5 or more cases, given as indicated that the expected number was 2. Thus even under the unrealistic assumption that if no tract were to be in more than one 15-tract set, there would be about 10 such sets with 5 or more cases during 2010-2015 in the two Counties, and the true number appearing by chance would be substantially larger. We conclude therefore that the extra 3 cases can be explained reasonably on the basis of chance alone and that we have been unable to find evidence of local childhood cancers caused by SSFL. As you well know, we have to carefully say that we cannot rule out such causation, and can only say that we have been unable to find support for it.

I hope this explanation is satisfactory. If you have further questions, don't hesitate to ask.

Thomas Mack MD, MPH.